REMARKS

Applicant respectfully requests reconsideration of the present application in view of the foregoing amendments and in view of the reasons that follow.

No claims have been amended or cancelled. Claims 1-5, 8, 9, 13, 14, 18 and 20 remain in the application.

Claim Rejections - 35 U.S.C. § 103

In the Final Office Action, the PTO rejected independent claims 1 and 11, as well as dependent claims 4-5, 8, 13, 14, 18 and 20, under 35 U.S.C. § 103(a) as being unpatentable over Takahara in view of Sato, Tran, and Okumura. Dependent claim 9 is rejected over this basic combination of references plus Ohara. These are the only issues remaining in the case. Applicants respectfully request reconsideration of these grounds of rejection in light of the factual information that is presented below, which demonstrates that the rationale for the stated rejections is not consistent with the knowledge of a person of ordinary skill in the art of the invention, i.e., there is no proper basis for combining the references.

In the Final Office Action, the PTO alleges that "Okumura is relied upon for its teaching regarding the coupling of a rare-earth oxysulfide phosphor layer with a photodiode or other photosensor. In such case, Okumura teaches that surface roughness of the scintillating phosphor layer should be between 0.01 μm and 0.8 μm in order to improve the matching characteristic between the phosphor layer and the photodiode, thereby improving the optical output characteristic [citation omitted]. The teachings provided by Okumura would extend to any type of phosphor coupled with a photodiode, regardless of the method of fabrication, since the optical characteristics are a direct product of the phosphor layer surface [citation omitted]."

The Applicants respectfully disagree and submit that the PTO's opinion is not supported by the factual evidence. The differences between a phosphor sheet for a radiation detector of claims 1 and 11 in the present invention, on the one hand, and a ceramic

scintillator of Okumura, on the other hand, are explained below, in order to show that the basic premise upon which the PTO bases its rejections is not one to which a person skilled in the art would have been led, i.e. the basis for allegedly combining the references would not have been suggested to the artisan.

The phosphor sheet of the present invention comprises a phosphor layer including a layer coated on the support with powder of a rare earth oxysulfide phosphor. The phosphor layer (phosphor powder coated layer) in the present invention is made by coating the phosphor powder on the support. In contrast, the ceramic scintillator of Okumura comprises a sintered body of a rare earth oxysulfide phosphor and a rare earth oxide phase formed on the surface of the sintered body. The ceramic scintillator piece of Okumura is a rod-like scintillator having a thickness of about 2 mm, a width of about 1 mm and a length of about 30 mm (column 5, lines 61-63).

Thus, the form of the phosphor layer in the present invention differs from that of the ceramic scintillator of Okumura. The difference in the form of the phosphor layer and the ceramic scintillator brings about differences in surface roughness, in the coupling structure with the photoelectric conversion film, and in characteristics based on the coupling structure.

First, the phosphor layer of the invention and the ceramic scintillator of Okumura are made in completely different ways and have different resulting structures. The phosphor layer in the present invention includes the phosphor powder coated layer, so that the surface having surface roughness Ra of 0.5 μn or less is obtained by performing a smoothing treatment for the surface of the phosphor layer by using a metal roll or a metal plate (paragraph [0068]). In contrast, the ceramic scintillator of Okumura includes the sintered body, so that the surface having surface roughness Ra in the range of 0.01 to 0.8 μm is obtained by etching or polishing the surface of the sintered body (column 6, lines 23-38).

More significantly, as explained below, the structure and function of the phosphor layer of the invention and the ceramic scinitillator of the reference are completely different. Thus, the latter provides no motivation whatsoever for the former. The phosphor layer in the present invention is layered on the photoelectric conversion film, and the photoelectric

conversion film contacts a plurality of pixels of a charge information reading section. The photoelectric conversion film and the charge information reading section form an optical detection part of a radiation detector. This layered structure is shown in Exhibit Figure 1 attached. In Exhibit Figure 1, "8" is a phosphor sheet, "11" is a support, "12" is a phosphor layer, "10" is an optical detection part, "20" is a photoelectric conversion film, "30" is a charge information reading section, "31, 31" are pixels, and "X" is a phosphor particle. As shown in Exhibit Figure 1, the phosphor layer 12 is not divided corresponding to pixels 31.

In contrast, an X-ray detector according to Okumura includes a plurality of scintillators 1 and a plurality of photodiodes 22 as shown in FIG. 10 to FIG. 12 of the reference patent. The plurality of scintillators 1 correspond with the plurality of photodiodes 22, and one scintillator 1 is disposed on one photodiode 22. Each of a plurality of reflectors 23 is provided between scintillators 1 (column 10, lines 23-42).

In the radiation detector including the phosphor sheet of the present invention, the resolution of the radiation image is influenced by definition. Since the phosphor layer in the present invention is composed of the phosphor powder, if light is scattered between the phosphor layer and the photoelectric conversion film, as shown in Exhibit Figure 2 attached, the definition of the radiation image deteriorates. In order to improve the definition and resolution of the radiation image, the surface of the phosphor layer in the present invention has a surface roughness Ra of 0.5 μm or less. By setting the surface roughness of the surface of the phosphor layer at 0.5 μm or less average roughness Ra, the light emitted at the phosphor layer is difficult to scatter when incident on the photoelectric conversion film, and therefore, it becomes possible to enhance the definition and resolution of the radiation image (paragraph [0067]).

On the other hand, this basic principle of operation is nowhere found in Okumura. The resolution of the X-ray detector of Okumura is determined based on a completely different principle, i.e., based on the size of one photodiode 22. It is because the scintillators correspond with the photodiodes, and each of the reflectors is provided between scintillators. The surface of the ceramic scintillator of Okumura has surface roughness Ra in the range of

0.01 to 0.8 μm only to improve luminous intensity. Okumura does not teach or have the intention of improving the resolution.

In the X-ray detector of Okumura, an air gap exists between the scintillators and the photodiodes, so that multiple scattering of light in the interface based on the difference in refractive index causes a problem as shown in Exhibit Figure 3 attached. In order to improve luminous intensity based on the multiple scattering, Okumura makes the surface roughness Ra of the ceramic scintillator in the range of 0.01 to 0.8 μm.

The phosphor layer in the present invention has surface roughness Ra of 0.5 μm or less to improve the definition and resolution of the radiation image. In contrast, the ceramic scintillator of Okumura has a surface roughness Ra in the range of 0.01 to 0.8 μm to improve luminous intensity, but not to improve the definition and resolution. Thus, the reason for having and the principle of operation of the surface roughness Ra of the phosphor layer in the present invention differ completely from those of the ceramic scintillator of Okumura. Consequently, it is not the prior art references that suggest making the phosphor layer of the invention have a surface roughness Ra of 0.5 μm or less, but rather the PTO has improperly arrived at this portion of the claimed invention based solely on the hindsight knowledge of the present invention. The alleged reason for combining Okumura with the other references is technologically unsupported, and the cited evidence therefore fails to properly support the alleged obviousness rejection.

In summary, the surface characteristics of the phosphor layer in the present invention differ from those of the ceramic scintillator of Okumura, so that the scattering behavior of light in the surface of the phosphor layer differs from that in the surface of the ceramic scintillator. Even if the surface roughness Ra of the phosphor layer and the ceramic scintillator may overlap to some degree in their definition, they are provided for different reasons, and further the respective influence of the light scattering differ completely in function and purpose.

The surface roughness Ra of the phosphor layer in the present invention is not therefore suggested to a person skilled in the art by the surface roughness Ra of the ceramic

scintillator of Okumura. The surface roughness Ra provided for improving luminous intensity in Okumura does not suggest to the artisan to provide the same surface roughness Ra for the completely different purpose of improving the definition and resolution of the radiation image in the layered construction of the present invention. Therefore, the person skilled in the art finds no rationale basis or suggestion from the proposed combination of Takahara in view of Sato, Tran and Okumura to provide any particular surface roughness to the phosphor sheet in claim 1 or the radiation detector of claim 11, i.e., the claimed invention is not rendered obvious *to a person skilled in the art* from these four prior art references.

Further, Takahara discloses an apparatus for color radiography comprising a radiation source, color light emitting means, and light detecting means. The color light emitting means comprises a color light emission sheet that includes a sheet base and a phosphor layer. However, the light detecting means comprise a color X-ray film or a color camera (for example, color CCD camera). Thus, Takahara does not disclose the combination of the phosphor sheet and the photoelectric conversion film. Nor does Takahara teach that the phosphor layer has the surface layered on the photoelectric conversion film, or that the surface of the phosphor layer should have a surface roughness Ra of 0.5 μm or less.

Tran discloses that, on top of the photosensitive module, is a layer of phosphor. However, the phosphor layer of Tran is directly formed on the top of the photosensitive module. Tran does not include a phosphor sheet having the phosphor layer formed on the support. Nor does Tran disclose the combination of the phosphor sheet and the photoelectric conversion film.

Sato discloses a scintillator panel comprising a scintillator formed on a radiation-transparent substrate. In Sato, Tl-doped CsI is used in the scintillator. Sato does not include the phosphor sheet having a rare earth oxysulfide phosphor, and therefore Sato does not disclose the combination of the phosphor sheet having a rare earth oxysulfide phosphor and the photoelectric conversion film.

Therefore, neither the phosphor sheet in claim 1 nor the radiation detector of claim 11 is rendered obvious by Takahara in view of Sato, Tran and Okumura, at least since there is no

proper basis for combining these references to support the rejection. The rejection of claim 9 suffers at least the same basic defect. Applicants respectfully request reconsideration and withdrawal of the stated rejection.

Applicant believes that the present application is now in condition for allowance. Favorable reconsideration of the application is respectfully requested, in light of the clear technological differences discussed above.

The Examiner is invited to contact the undersigned by telephone if it is felt that a telephone interview would advance the prosecution of the present application.

The Commissioner is hereby authorized to charge any additional fees which may be required regarding this application under 37 C.F.R. §§ 1.16-1.17, or credit any overpayment, to Deposit Account No. 19-0741. Should no proper payment be enclosed herewith, as by a check or credit card payment form being in the wrong amount, unsigned, post-dated, otherwise improper or informal or even entirely missing, the Commissioner is authorized to charge the unpaid amount to Deposit Account No. 19-0741. If any extensions of time are needed for timely acceptance of papers submitted herewith, Applicant hereby petitions for such extension under 37 C.F.R. § 1.136 and authorizes payment of any such extensions fees to Deposit Account No. 19-0741.

Respectfully submitted,

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By 

FOLEY & LARDNER LLP
Customer Number: 22428
Telephone: (202) 672-5414
Facsimile: (202) 672-5399

Richard L. Schwaab
Attorney for Applicant
Registration No. 25,479